

December 10, 2001

BOX PCT

Commissioner for Patents
Washington, D.C. 20231

PCT/JP00/03767

-filed June 9, 2000

Re: Application of Hiroyuki HISAMICHI, Souichirou KAWAZOE, Kazuhito
TANABE, Atsushi ICHIKAWA, Akiko ORITA, Takayuki SUZUKI,
Kenichi ONDA and Makoto TAKEUCHI
NOVEL HETEROCYCLECARBOXAMIDE DERIVATIVE
Assignee: YAMANOUCHI PHARMACEUTICAL CO., LTD.
Our Ref: Q67050

Dear Sir:

The following documents and fees are submitted herewith in connection with the above application for the purpose of entering the National stage under 35 U.S.C. § 371 and in accordance with Chapter II of the Patent Cooperation Treaty:

- an executed Declaration and Power of Attorney.
- an English translation of the International Application.
- Notification Concerning Submission or Transmittal of Priority Document
- a Statement to Support Filing and Submission in accordance with 37 C.F.R. § 1.821-1.825, with attached 1-page of Sequence Listing and Diskette containing Sequence Listing
- an executed Assignment and PTO 1595 form.
- International Search Report, Information Disclosure Statement and PTO form 1449.
- a Preliminary Amendment

It is assumed that copies of the International Application, the International Preliminary Examination Report, and any Articles 19 and 34 amendments as required by § 371(c) will be supplied directly by the International Bureau, but if further copies are needed, the undersigned can easily provide them upon request.

The Government filing fee is calculated as follows:

| | | | | | | | | |
|--------------------|---|---|----|---|-------|-----------|---|----------|
| Total claims | 6 | - | 20 | = | _____ | x \$18.00 | = | \$0.00 |
| Independent claims | 1 | - | 3 | = | _____ | x \$84.00 | = | \$0.00 |
| Base Fee | | | | | | | | \$890.00 |

| | | |
|----------------------------------|-------|-----------------|
| TOTAL FILING FEE | _____ | \$890.00 |
| Recordation of Assignment | _____ | \$ 40.00 |
| TOTAL FEE | _____ | \$930.00 |



Q67050

Checks for the statutory filing fee of \$890.00 and Assignment recordation fee of \$40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16, 1.17 and 1.492 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from:

| <u>Country</u> | <u>Application No</u> | <u>Filing Date</u> |
|----------------|-----------------------|--------------------|
| Japan | P.Hei. 11-162692 | June 9, 1999 |

Respectfully submitted,


Mark Boland
Registration No. 32,197

MXB/slb

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hiroyuki HISAMICHI, et al.

Appln. No.: NOT YET ASSIGNED

Confirmation No.: NOT YET ASSIGNED

Group Art Unit: NOT YET ASSIGNED

Filed: December 10, 2001

Examiner: NOT YET ASSIGNED

For: NOVEL HETEROCYCLECARBOXAMIDE DERIVATIVE

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

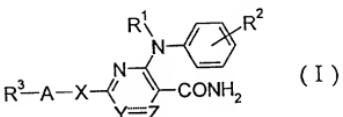
Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Page 6, first full paragraph

Namely, the invention relates to a novel heterocyclecarboxamide derivative represented by the following general formula (I) or a pharmaceutically acceptable salt thereof, and a medicament comprising the same as the active ingredient.



(wherein the symbols in the formula have the following meanings.

A: a lower alkylene which may have substituent(s), an arylene which may have substituent(s), a heteroarylene which may have substituent(s), a cycloalkylene which may have substituent(s), or H;

X: NR⁴, CONR⁴, NR⁴CO, O, or S;

a dotted line between Y and Z: presence (Y=Z) or absence (Y-Z) of a bond;

Y-Z: N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O);

Y=Z: N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷);

R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower alkyl;

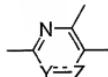
R²: H, a lower alkyl, a halogen, a lower alkyl substituted by halogen(s), -O-lower alkyl, -S-lower alkyl, -O-aryl, -O-lower alkylene-aryl, -S-lower alkylene-aryl, nitro, cyano, -OCH₂O-, or -(CH=CH-CH=CH)-; R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower alkylene-CO₂-lower alkyl, -CONHOH, -CONHO-lower alkyl, -lower alkylene-CONHOH, -lower alkylene-CONHO-lower alkyl, -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form);

R⁵: H or a lower alkyl group;

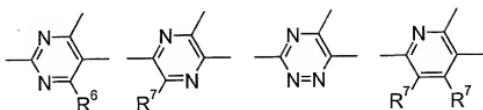
R⁶: a lower alkyl, -OH, -O-lower alkyl, -O-aryl which may have substituent(s), -O-lower alkylene-aryl which may have substituent(s), -NR¹-aryl which may have substituent(s), -CO-lower alkyl, or -aryl group which may have substituent(s);

R⁷: the same or different, H or the same group as R⁶. The same shall apply to the following).

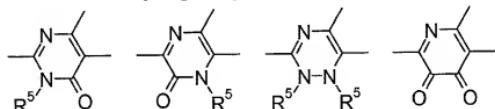
By the way, when Y=Z represents N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷) in the formula, the central heterocycle part:



represents any of the following formulae:



and when Y-Z represents N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O) in the formula, the central heterocycle part represents any of the following formulae.



Page 11, between lines 2 & 3, please insert the following paragraph

The substituent R² on the anilino group in the formula (I) represents one group or a plural number of groups (e.g., "3, 5-Me" means "3,5-dimethyl"). R² also represents -OCH₂O- or -(CH=CH-CH=CH)-, wherein -OCH₂O means a methylenedioxy group and -(CH=CH-CH=CH)-, wherein -OCH₂O- means a methylenedioxy group and -(CH=CH-CH=CH)- means a naphthyl group together with the adjacent benzene ring.

Page 23, first full paragraph

A peptide of 18 amino acid residues (MEELQDDYEDMMEEENLEQ) (SEQ ID NO:1) containing Tyr-8 of human erythrocyte Band 3 (Harrison, M. L. et al., J. Biol. Chem., 269: 955-959 (1994)) was synthesized using a peptide synthesizer. Using a biotinylation kit manufactured by Pierce, the N-terminal of the peptide in a resin-linked state was biotinylated, and purification was carried out using an HPLC.

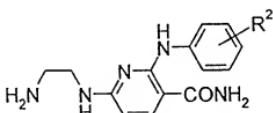
Page 35, second full paragraph

Rex: Reference Example number, Ex: Example number, Cmpd: compound number, Ph: phenyl, Me: methyl, Et: ethyl, tBu: tert-butyl, Boc: tBuO-CO-, Bn: benzyl, Ac: acetyl, BCA: cis-2-(tert-butoxycarbonylamino)cyclohexylamino, PEA: (1'S,1R,2S)-2-(1'-

represents a 2-naphthyl group together with the adjacent benzene ring, and OCH₂O represents methylenedioxy group.

Page 38, please delete table 3 and insert the following new table 3:

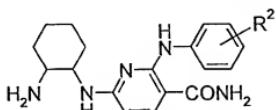
Table 3



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 1 | 2-Br | 10 | 2-H ₂ N | 19 | 2-PhO | 28 | 2-Bu |
| 2 | 3-Br | 11 | 3-H ₂ N | 20 | 3-PhO | 29 | 3-Bu |
| 3 | 4-Br | 12 | 4-H ₂ N | 21 | 4-PhO | 30 | 4-Bu |
| 4 | 2-Cl | 13 | 2-Ac | 22 | 2-MeO | 31 | 3,5-Cl |
| 5 | 3-Cl | 14 | 3-Ac | 23 | 3-MeO | 32 | 3,5-MeO |
| 6 | 4-Cl | 15 | 4-Ac | 24 | 4-MeO | 33 | 3,5-Me |
| 7 | 2-HOCH ₂ | 16 | 2-MeS | 25 | 2-Me | 34 | 2,3-OCH ₂ O |
| 8 | 3-HOCH ₂ | 17 | 3-MeS | 26 | 3-Me | 35 | 3,4-OCH ₂ O |
| 9 | 4-HOCH ₂ | 18 | 4-MeS | 27 | 4-Me | 36 | 3,4-(CH=C H-CH=CH) |

Page 38, please delete table 4 and insert the following new table 4:

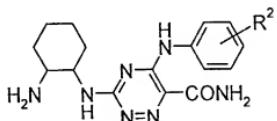
Table 4



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 37 | 2-Br | 46 | 2-H ₂ N | 55 | 2-PhO | 64 | 3-Et |
| 38 | 3-Br | 47 | 3-H ₂ N | 56 | 3-PhO | 65 | 4-Et |
| 39 | 4-Br | 48 | 4-H ₂ N | 57 | 4-PhO | 66 | 3-Pr |
| 40 | 2-Cl | 49 | 2-Ac | 58 | 2-MeO | 67 | 3-Bu |
| 41 | 3-Cl | 50 | 3-Ac | 59 | 3-MeO | 68 | 3,5-Cl |
| 42 | 4-Cl | 51 | 4-Ac | 60 | 4-MeO | 69 | 3,5-MeO |
| 43 | 2-HOCH ₂ | 52 | 2-MeS | 61 | 2-Me | 70 | 2,3-OCH ₂ O |
| 44 | 3-HOCH ₂ | 53 | 3-MeS | 62 | 4-Me | 71 | 3,4-OCH ₂ O |
| 45 | 4-HOCH ₂ | 54 | 4-MeS | 63 | 2-Et | 72 | 3,4-(CH=C H-CH=CH) |

Page 40, please delete table 6 and insert the following new table 6

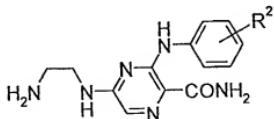
Table 6



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 121 | 2-Br | 130 | 2-H ₂ N | 139 | 2-PhO | 148 | 2-Et |
| 122 | 3-Br | 131 | 3-H ₂ N | 140 | 3-PhO | 149 | 3-Et |
| 123 | 4-Br | 132 | 4-H ₂ N | 141 | 4-PhO | 150 | 4-Et |
| 124 | 2-Cl | 133 | 2-Ac | 142 | 2-MeO | 151 | 3,5-Cl |
| 125 | 3-Cl | 134 | 3-Ac | 143 | 3-MeO | 152 | 3,5-MeO |
| 126 | 4-Cl | 135 | 4-Ac | 144 | 4-MeO | 153 | 3,5-Me |
| 127 | 2-HOCH ₂ | 136 | 2-MeS | 145 | 2-Me | 154 | 2,3-OCH ₂ O |
| 128 | 3-HOCH ₂ | 137 | 3-MeS | 146 | 3-Me | 155 | 3,4-OCH ₂ O |
| 129 | 4-HOCH ₂ | 138 | 4-MeS | 147 | 4-Me | 156 | 3,4-(CH=C H-CH=CH) |

Page 40, please delete table 7 and insert the following new table 7:

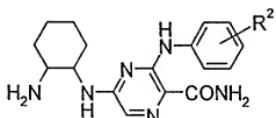
Table 7



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|----------------|------|---------------------|------|----------------|------|------------------------|
| 157 | 2-Br | 166 | 2-HOCH ₂ | 175 | 2-MeS | 184 | 4-Me |
| 158 | 3-Br | 167 | 3-HOCH ₂ | 176 | 3-MeS | 185 | 2-Et |
| 159 | 4-Br | 168 | 4-HOCH ₂ | 177 | 4-MeS | 186 | 3-Et |
| 160 | 2-Cl | 169 | 2-H ₂ N | 178 | 2-PhO | 187 | 4-Et |
| 161 | 3-Cl | 170 | 3-H ₂ N | 179 | 3-PhO | 188 | 3,5-MeO |
| 162 | 4-Cl | 171 | 4-H ₂ N | 180 | 4-PhO | 189 | 3,5-Me |
| 163 | 2-F | 172 | 2-Ac | 181 | 2-MeO | 190 | 2,3-OCH ₂ O |
| 164 | 3-F | 173 | 3-Ac | 182 | 4-MeO | 191 | 3,4-OCH ₂ O |
| 165 | 4-F | 174 | 4-Ac | 183 | 2-Me | 192 | 3,4-(CH=C H-CH=CH) |

Page 42, please delete table 9 and insert the following new table 9:

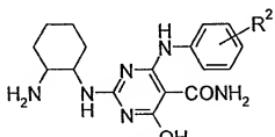
Table 9



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|-------------------|------|------------------------|
| 241 | 2-Br | 250 | 2-H ₂ N | 259 | 2-PhO | 268 | 2-CN |
| 242 | 4-Br | 251 | 3-H ₂ N | 260 | 4-PhO | 269 | 3-CN |
| 243 | 2-Cl | 252 | 4-H ₂ N | 261 | 2-MeO | 270 | 4-CN |
| 244 | 4-Cl | 253 | 2-Ac | 262 | 4-MeO | 271 | 3,5-Br |
| 245 | 2-F | 254 | 3-Ac | 263 | 2-Et | 272 | 3,5-Cl |
| 246 | 4-F | 255 | 4-Ac | 264 | 4-Et | 273 | 3,5-F |
| 247 | 2-HOCH ₂ | 256 | 2-MeS | 265 | 2-NO ₂ | 274 | 2,3-OCH ₂ O |
| 248 | 3-HOCH ₂ | 257 | 3-MeS | 266 | 3-NO ₂ | 275 | 3,4-OCH ₂ O |
| 249 | 4-HOCH ₂ | 258 | 4-MeS | 267 | 4-NO ₂ | 276 | 3,4-(CH=C H-CH=CH) |

Page 42, please delete table 10 and insert the following new table 10:

Table 10

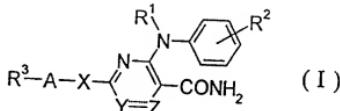


| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 277 | 2-F | 286 | 2-H ₂ N | 295 | 2-PhO | 304 | 2-Bu |
| 278 | 3-F | 287 | 3-H ₂ N | 296 | 3-PhO | 305 | 3-Bu |
| 279 | 4-F | 288 | 4-H ₂ N | 297 | 4-PhO | 306 | 4-Bu |
| 280 | 2-Cl | 289 | 2-Ac | 298 | 2-MeO | 307 | 3,5-Cl |
| 281 | 3-Cl | 290 | 3-Ac | 299 | 3-MeO | 308 | 3,5-MeO |
| 282 | 4-Cl | 291 | 4-Ac | 300 | 4-MeO | 309 | 3,5-Me |
| 283 | 2-HOCH ₂ | 292 | 2-MeS | 301 | 2-Et | 310 | 2,3-OCH ₂ O |
| 284 | 3-HOCH ₂ | 293 | 3-MeS | 302 | 3-Et | 311 | 3,4-OCH ₂ O |
| 285 | 4-HOCH ₂ | 294 | 4-MeS | 303 | 4-Et | 312 | 3,4-(CH=C H-CH=CH) |

IN THE CLAIMS:

Please enter the following amended claim:

1. (Amended) A heterocyclecarboxamide derivative represented by the general formula
(I) or a salt thereof.



wherein the symbols in the formula have the following meanings:

A: a lower alkylene which may have substituent(s), an arylene which may have substituent(s), a heteroarylene which may have substituent(s), or a cycloalkylene which may have substituent(s);

X: NR⁴, CONR⁴, NR⁴CO, O, or S;

a dotted line between Y and Z: presence (Y=Z) or absence (Y-Z) of a bond;

Y-Z: N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O);

Y=Z: N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷);

R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower alkyl;

R²: H, a lower alkyl, a halogen, a lower alkyl substituted by halogen(s), -O-lower alkyl, -S-lower alkyl, -O-aryl, -O-lower alkylene-aryl, -S-lower alkylene-aryl, nitro, cyano, -OCH₂O, or -

(CH=CH-CH=CH)-;

R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower alkylene-CO₂-lower alkyl, -CONHOH, -CONHO-lower alkyl, -lower alkylene-CONHOH, -lower alkylene-CONHO-lower alkyl, -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form);

R⁵: the same or different, H or a lower alkyl group;

R^6 : a lower alkyl, -OH, -O-lower alkyl, -O-aryl which may have substituent(s), -O-lower alkylene-aryl which may have substituent(s), -NR¹-aryl which may have substituent(s), -CO-lower alkyl, or -aryl group which may have substituent(s); and

R^7 : the same or different, H or the same group as R^6 .

REMARKS

Entry and consideration of this Amendment is respectfully requested. Support for the amendments are as follows:

(1) The support for the changes from "3,4-(CH)₄" at page 35 and Tables to "3,4-(CH=CH-CH=CH)" is as follows. Please note that all changes in the Tables related to "3,4-(CH)₄".

At page 35, lines 17-19, it is described that "a compound in which R^2 is 3,4-(CH)₄ represents a 2-naphthyl group together with the adjacent benzene ring", which means that the description about "3,4-(CH)₄" means a naphthyl group. In order to further clarify that the definition means a naphthyl group, please change "3,4-(CH)₄" to "3,4-(CH=CH-CH=CH)". The compounds amended in this regard has 3,4-(CH=CH-CH=CH) as R^2 .

(2) The support for the addition of "-OCH₂O-", or -(CH=CH-CH=CH)-" in Claim 1 and page 6, lines 23-24 is as follows.

The following compounds wherein R^2 is 2,3-OCH₂O or 3,4-OCH₂O are described.

Page 38, Table 3: Compound 34 and 35

Page 38, Table 4: Compound 70 and 71

Page 40, Table 6: Compound 154 and 155

Page 40, Table 7: Compound 190 and 191

Page 42, Table 9: Compound 274 and 275

Page 42, Table 10: Compound 310 and 311

The following compounds wherein R^2 is 3,4-(CH=CH-CH=CH)
(i.e., 3,4-(CH)₄" before amendments) are described.

Page 38, Table 3: Compound 36
Page 38, Table 4: Compound 72
Page 40, Table 6: Compound 156
Page 40, Table 7: Compound 192
Page 42, Table 9: Compound 276

Accordingly, addition of "-OCH₂O-", or -(CH=CH-CH=CH)-" is sufficiently supported by these descriptions.

(3) The support for the addition of " R^2 also represents -OCH₂O- or -(CH=CH-CH=CH)-, wherein -OCH₂O- means a methylenedioxy group and -(CH=CH-CH=CH)- means a naphthyl group together with the adjacent benzene ring." into page 11 is as follows.

It is described at page 35, lines 17-20 that "a compound in which R^2 is 3,4-(CH=CH-CH=CH) represents a 2-naphthyl group together with the adjacent benzene ring, and OCH₂O represents methylenedioxoy group."

(4) The support for the addition of "The substituent R^2 on the anilino group in the formula (I) represents one or a plural number of groups (e.g., "3,5-Me" means "3,5-dimethyl")." into page 11 is as follows.

The following compounds are described.

Page 37, Table 2: Examples 7, 10, 14
Page 38, Table 3: Compound 31, 32, 33
Page 38, Table 4: Compound 68, 69
Page 40, Table 6: Compound 151, 152, 153
Page 40, Table 7: Compound 188, 189
Page 42, Table 9: Compound 271, 272, 273
Page 42, Table 10: Compound 307, 308, 309

In these compounds, R² is 3,5-Me, 3,5-MeO, 3,5-Cl, 3,5-Br, or 3,5-F. In this regard, it is explained at page 35, lines 4-7 that "the number before ... For example, 3,5-Me indicates 3,5-dimethyl". Based on the Examples and this description, it is originally disclosed that R² means one or a plural number of groups.

Respectfully submitted,



Mark Boland
Registration No. 32,197

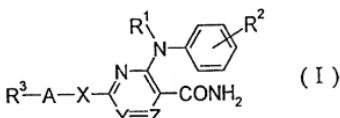
SUGHRUE MION, PLLC
2100 Pennsylvania Avenue, N.W.
Washington, D.C. 20037-3213
Telephone: (202) 293-7060
Facsimile: (202) 293-7860
MXB/slb
Date: December 10, 2001

APPENDIXVERSION WITH MARKINGS TO SHOW CHANGES MADEIN THE SPECIFICATION:

The specification is changed as follows:

Page 6, first full paragraph

Namely, the invention relates to a novel heterocyclecarboxamide derivative represented by the following general formula (I) or a pharmaceutically acceptable salt thereof, and a medicament comprising the same as the active ingredient.



(wherein the symbols in the formula have the following meanings.

A: a lower alkylene which may have substituent(s), an arylene which may have substituent(s), a heteroarylene which may have substituent(s), a cycloalkylene which may have substituent(s), or H;

X: NR⁴, CONR⁴, NR⁴CO, O, or S;

a dotted line between Y and Z: presence (Y=Z) or absence (Y-Z) of a bond;

Y-Z: N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O);

Y=Z: N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷);

R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower alkyl;

R²: H, a lower alkyl, a halogen, a lower alkyl substituted by halogen(s), -O-lower alkyl, -S-lower alkyl, -O-aryl, -O-lower alkylene-aryl, -S-lower alkylene-aryl, nitro, or cyano, or ~~group~~ -OCH₂O-, or -(CH=CH-CH=CH)-;

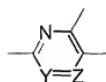
R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower alkylene-alkylene-CO₂-lower alkyl, -CONHOH, -CONHO-lower alkyl, -lower alkylene-CONHOH, -lower alkylene-CONHO-lower alkyl, -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form);

R⁵: H or a lower alkyl group;

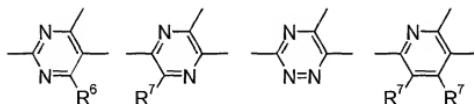
R⁶: a lower alkyl, -OH, -O-lower alkyl, -O-aryl which may have substituent(s), -O-lower alkylene-aryl which may have substituent(s), -NR¹-aryl which may have substituent(s), -CO-lower alkyl, or -aryl group which may have substituent(s);

R⁷: the same or different, H or the same group as R⁶. The same shall apply to the following).

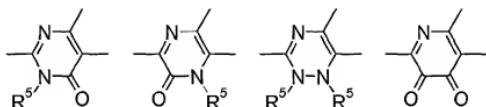
By the way, when Y=Z represents N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷) in the formula, the central heterocycle part:



represents any of the following formulae:



and when Y-Z represents N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O) in the formula, the central heterocycle part represents any of the following formulae.



Page 23, first full paragraph

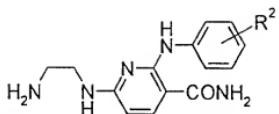
A peptide of 18 amino acid residues (MEELQDDYEDMMEEENLEQ) (Sequence No.: ~~+EQ ID NO:1~~) containing Tyr-8 of human erythrocyte Band 3 (Harrison, M. L. et al., J. Biol. Chem., 269: 955-959 (1994)) was synthesized using a peptide synthesizer. Using a biotinylation kit manufactured by Pierce, the N-terminal of the peptide in a resin-linked state was biotinylated, and purification was carried out using an HPLC.

Page 35, second full paragraph

Rex: Reference Example number, Ex: Example number, Cmpd: compound number, Ph: phenyl, Me: methyl, Et: ethyl, tBu: tert-butyl, Boc: tBuO-CO-, Bn: benzyl, Ac: acetyl, BCA: cis-2-(tert-butoxycarbonylamino)cyclohexylamino, PEA: (1'S,1R,2S)-2-(1'-phenylethylamino)cyclohexylamino, CCA: cis-2-aminocyclohexylamino, ACA: (1R,2S)-2-aminocyclohexylamino. Sal: salt (blank space: free form; HCl: hydrochloride), Dat: physicochemical data (F: FAB-MS (M+H)⁺; FN: FAB-MS (M-H)⁻; M: melting point (°C); A: specific rotation [α]_D (MeOH)). Also, a compound in which R² is 3,4-(CH₂)₄=CH-CH=CH₂, represents a 2-naphthyl group together with the adjacent benzene ring, and OCH₂O represents methylenedioxy group.

Page 38, Table 3

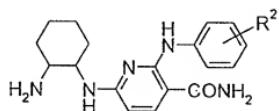
Table 3



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|-------------------------------------|
| 1 | 2-Br | 10 | 2-H ₂ N | 19 | 2-PhO | 28 | 2-Bu |
| 2 | 3-Br | 11 | 3-H ₂ N | 20 | 3-PhO | 29 | 3-Bu |
| 3 | 4-Br | 12 | 4-H ₂ N | 21 | 4-PhO | 30 | 4-Bu |
| 4 | 2-Cl | 13 | 2-Ac | 22 | 2-MeO | 31 | 3,5-Cl |
| 5 | 3-Cl | 14 | 3-Ac | 23 | 3-MeO | 32 | 3,5-MeO |
| 6 | 4-Cl | 15 | 4-Ac | 24 | 4-MeO | 33 | 3,5-Me |
| 7 | 2-HOCH ₂ | 16 | 2-MeS | 25 | 2-Me | 34 | 2,3-OCH ₂ O |
| 8 | 3-HOCH ₂ | 17 | 3-MeS | 26 | 3-Me | 35 | 3,4-OCH ₂ O |
| 9 | 4-HOCH ₂ | 18 | 4-MeS | 27 | 4-Me | 36 | 3,4-(CH ₂) ₄ |

3,4-(CH₂CH₂CH₂CH₂)₄Page 38, Table 4

Table 4

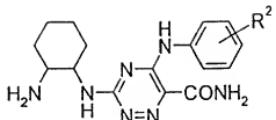


| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|-------------------------------------|
| 37 | 2-Br | 46 | 2-H ₂ N | 55 | 2-PhO | 64 | 3-Et |
| 38 | 3-Br | 47 | 3-H ₂ N | 56 | 3-PhO | 65 | 4-Et |
| 39 | 4-Br | 48 | 4-H ₂ N | 57 | 4-PhO | 66 | 3-Pr |
| 40 | 2-Cl | 49 | 2-Ac | 58 | 2-MeO | 67 | 3-Bu |
| 41 | 3-Cl | 50 | 3-Ac | 59 | 3-MeO | 68 | 3,5-Cl |
| 42 | 4-Cl | 51 | 4-Ac | 60 | 4-MeO | 69 | 3,5-MeO |
| 43 | 2-HOCH ₂ | 52 | 2-MeS | 61 | 2-Me | 70 | 2,3-OCH ₂ O |
| 44 | 3-HOCH ₂ | 53 | 3-MeS | 62 | 4-Me | 71 | 3,4-OCH ₂ O |
| 45 | 4-HOCH ₂ | 54 | 4-MeS | 63 | 2-Et | 72 | 3,4-(CH ₂) ₄ |

3,4-(CH₂CH₂CH₂CH₂)₄

Page 40, Table 6

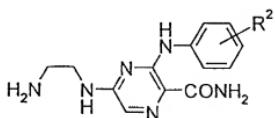
Table 6



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|-------------------------------------|
| 121 | 2-Br | 130 | 2-H ₂ N | 139 | 2-PhO | 148 | 2-Et |
| 122 | 3-Br | 131 | 3-H ₂ N | 140 | 3-PhO | 149 | 3-Et |
| 123 | 4-Br | 132 | 4-H ₂ N | 141 | 4-PhO | 150 | 4-Et |
| 124 | 2-Cl | 133 | 2-Ac | 142 | 2-MeO | 151 | 3,5-Cl |
| 125 | 3-Cl | 134 | 3-Ac | 143 | 3-MeO | 152 | 3,5-MeO |
| 126 | 4-Cl | 135 | 4-Ac | 144 | 4-MeO | 153 | 3,5-Me |
| 127 | 2-HOCH ₂ | 136 | 2-MeS | 145 | 2-Me | 154 | 2,3-OCH ₂ O |
| 128 | 3-HOCH ₂ | 137 | 3-MeS | 146 | 3-Me | 155 | 3,4-OCH ₂ O |
| 129 | 4-HOCH ₂ | 138 | 4-MeS | 147 | 4-Me | 156 | 3,4-(CH ₂) ₃ |

3,4-(CH=CH-CH=CH)Page 40, Table 7

Table 7

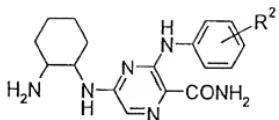


| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|----------------|------|---------------------|------|----------------|------|-------------------------------------|
| 157 | 2-Br | 166 | 2-HOCH ₂ | 175 | 2-MeS | 184 | 4-Me |
| 158 | 3-Br | 167 | 3-HOCH ₂ | 176 | 3-MeS | 185 | 2-Et |
| 159 | 4-Br | 168 | 4-HOCH ₂ | 177 | 4-MeS | 186 | 3-Et |
| 160 | 2-Cl | 169 | 2-H ₂ N | 178 | 2-PhO | 187 | 4-Et |
| 161 | 3-Cl | 170 | 3-H ₂ N | 179 | 3-PhO | 188 | 3,5-Cl |
| 162 | 4-Cl | 171 | 4-H ₂ N | 180 | 4-PhO | 189 | 3,5-Me |
| 163 | 2-F | 172 | 2-Ac | 181 | 2-MeO | 190 | 2,3-OCH ₂ O |
| 164 | 3-F | 173 | 3-Ac | 182 | 4-MeO | 191 | 3,4-OCH ₂ O |
| 165 | 4-F | 174 | 4-Ac | 183 | 2-Me | 192 | 3,4-(CH ₂) ₃ |

3,4-(CH=CH-CH=CH)

Page 42, Table 9

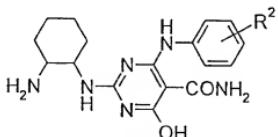
Table 9



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|-------------------|------|------------------------|
| 241 | 2-Br | 250 | 2-H ₂ N | 259 | 2-PhO | 268 | 2-CN |
| 242 | 4-Br | 251 | 3-H ₂ N | 260 | 4-PhO | 269 | 3-CN |
| 243 | 2-Cl | 252 | 4-H ₂ N | 261 | 2-MeO | 270 | 4-CN |
| 244 | 4-Cl | 253 | 2-Ac | 262 | 4-MeO | 271 | 3,5-Br |
| 245 | 2-F | 254 | 3-Ac | 263 | 2-Et | 272 | 3,5-Cl |
| 246 | 4-F | 255 | 4-Ac | 264 | 4-Et | 273 | 3,5-F |
| 247 | 2-HOCH ₂ | 256 | 2-MeS | 265 | 2-NO ₂ | 274 | 2,3-OCH ₂ O |
| 248 | 3-HOCH ₂ | 257 | 3-MeS | 266 | 3-NO ₂ | 275 | 3,4-OCH ₂ O |
| 249 | 4-HOCH ₂ | 258 | 4-MeS | 267 | 4-NO ₂ | 276 | 3,4-(CH) ₄ |

3,4-(CH=CH-CH=CH)Page 42, Table 10

Table 10



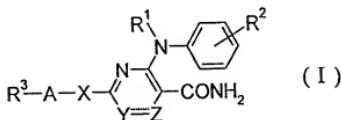
| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 277 | 2-F | 286 | 2-H ₂ N | 295 | 2-PhO | 304 | 2-Bu |
| 278 | 3-F | 287 | 3-H ₂ N | 296 | 3-PhO | 305 | 3-Bu |
| 279 | 4-F | 288 | 4-H ₂ N | 297 | 4-PhO | 306 | 4-Bu |
| 280 | 2-Cl | 289 | 2-Ac | 298 | 2-MeO | 307 | 3,5-Cl |
| 281 | 3-Cl | 290 | 3-Ac | 299 | 3-MeO | 308 | 3,5-MeO |
| 282 | 4-Cl | 291 | 4-Ac | 300 | 4-MeO | 309 | 3,5-Me |
| 283 | 2-HOCH ₂ | 292 | 2-MeS | 301 | 2-Et | 310 | 2,3-OCH ₂ O |
| 284 | 3-HOCH ₂ | 293 | 3-MeS | 302 | 3-Et | 311 | 3,4-OCH ₂ O |
| 285 | 4-HOCH ₂ | 294 | 4-MeS | 303 | 4-Et | 312 | 3,4-(CH) ₄ |

3,4-(CH=CH-CH=CH)

IN THE CLAIMS:

The claims are amended as follows:

1. (Amended) A heterocyclecarboxamide derivative represented by the general formula (I) or a salt thereof.



wherein the symbols in the formula have the following meanings:

A: a lower alkylene which may have substituent(s), an arylene which may have substituent(s), a heteroarylene which may have substituent(s), or a cycloalkylene which may have substituent(s);

X: NR⁴, CONR⁴, NR⁴CO, O, or S;

a dotted line between Y and Z: presence (Y=Z) or absence (Y-Z) of a bond;

Y-Z: N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O);

Y=Z: N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷);

R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower alkyl;

R²: H, a lower alkyl, a halogen, a lower alkyl substituted by halogen(s), -O-lower alkyl, -S-lower alkyl, -O-aryl, -O-lower alkylene-aryl, -S-lower alkylene-aryl, nitro, or cyano, -group-OCH₂O, or -(CH=CH-CH=CH)-;

R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower alkylenealkylene-CO₂-lower alkyl, -CONHOH, -CONHO-lower alkyl, -lower alkylene-CONHOH, -lower alkylene-CONHO-lower alkyl, -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form);

R⁵: the same or different, H or a lower alkyl group;

R⁶: a lower alkyl, -OH, -O-lower alkyl, -O-aryl which may have substituent(s), -O-lower alkylene-aryl which may have substituent(s), -NR¹-aryl which may have substituent(s), -CO-lower alkyl, or -aryl group which may have substituent(s); and

R⁷: the same or different, H or the same group as R⁶.

100009276-121001

Abstract

A nitrogen-containing six-membered heterocyclic compound having substituents -X-A-R³, -N(R¹)-(Ph substituted by R²), and -CONH₂, a salt thereof, a prodrug 5 thereof, and a Syk inhibitor containing the same as an active ingredient.

(In the formula, A: a (substituted) lower alkylene, a (substituted) arylene, or the like; X: NR⁴, CONR⁴, NR⁴CO, O, or S; R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower alkyl; R²: H, a (substituted) lower alkyl, -O-lower alkyl, -S-lower alkyl, -O-aryl, nitro, cyano, or the like; R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -NH₂, -alkylene-NH₂, or the like.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hiroyuki HISAMICHI et al.

Confirmation number: Not Yet Assigned

Appln. No.: Not Yet Assigned

Group Art Unit: Not Yet Assigned

Filed: December 10, 2001

Examiner: Not Yet Assigned

For: NOVEL HETEROCYCLECARBOXAMIDE DERIVATIVE

**STATEMENT TO SUPPORT FILING AND SUBMISSION IN ACCORDANCE WITH
37 C.F.R. §§ 1.821-1.825**

Assistant Commissioner for Patents
Washington, D.C. 20231
Box SEQUENCE

Sir:

In connection with a Sequence Listing submitted concurrently herewith, the undersigned hereby states that:

1. the content of the 1-page Sequence Listing being filed with the present application, and the attached computer readable copy of the Sequence Listing, submitted in accordance with 37 C.F.R. § 1.821(c) and (e), respectively, are the same; and

2. all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent resulting therefrom.

Respectfully submitted,



Drew Hissong
Registration No. 44,765

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Date: December 10, 2001

Description

NOVEL HETEROCYCLECARBOXAMIDE DERIVATIVE

5 Technical Field

The present invention relates to a heterocyclecarboxamide derivative useful as a medicament, particularly a Syk inhibitor.

10 Background of the Invention

It is known that type I (immediate type) allergic reaction which plays a main role at allergic diseases as typified by bronchial asthma, allergic rhinitis or atopic dermatitis is initiated by the interaction between an extrinsic antigen such as pollen or house dust and immunoglobulin E (IgE) specific thereto. IgE is captured on the cell surface of mast cell and basophile manifesting IgE receptor (Fc ε RI) having a high affinity. When the antigen binds thereto and cross-links the receptor, the cell is activated and inflammatory mediators such as histamine, serotonin and the like inducing anaphylaxis reaction are released from cytoplasmic secretory granules. Also, it is known that the production of cytokine which takes part in the progress of inflammatory reactions is accelerated.

It is known that at least two types of cytoplasmic tyrosine kinase, i.e., Lyn (Eiseman, E. and Bolen, J. B.,

Nature, 355: 78-80 (1992)) and Spleen tyrosine kinase (Syk) (Taniguchi, T. et al., J. Biol. Chem., 266: 15790-15796 (1991)), are concerned in the intracellular signal transduction which accompanies this Fc ε RI activation. It
5 is known that Syk undergoes tyrosine phosphorylation by the action of Lyn after crosslinking of Fc ε RI by an antigen, whereby the activity of the tyrosine kinase increases (Hutchcroft, J.E. et al., Proc. Natl. Acad. Sci. USA, 89: 9107-9111 (1992)). It has been also shown that the
10 activation of Syk are necessary for the degranulation and cytokine production acceleration induced by the activation of Fc ε RI (Rivera, V. M. and Brugge, J. S., Mol. Cell. Biol., 15: 1582-1590 (1995)).

Moreover, it is known that Syk is essential for a
15 life-extending signal of eosinophiles mediated by GM-CSF receptor, because antisense oligonucleotide of Syk inhibits the eosinophile's life-extending action of GM-CSF (Yousefi, S. et al., J. Exp. Med., 183: 1407-1414 (1996)).

As described above, it is expected that Syk takes
20 part in allergic or inflammatory reaction through controlling the functions of mast cell, basophile, and eosinophile.

In addition, Syk is suggested to be concerned in various diseases as described below.

25 It has been reported that Syk is deeply concerned in the phosphatidylinositol metabolism and increase in the intracellular calcium concentration caused by the

stimulation of B cell antigen receptor and thus plays an important role at the activation of B cells (Hutchcroft, J. E. et al., J. Biol. Chem., 267: 8613-8619 (1992) and Takata, M. et al., EMBO J., 13: 1341-1349 (1994)). In consequence, a Syk inhibitor may control the function of B cell and therefore is expected as an therapeutic agent for the diseases in which the antibody produced by B cell are concerned.

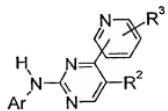
Also, it has been reported that Syk associates with a T cell antigen receptor and quickly undergoes tyrosine phosphorylation and is activated through crosslinking of the receptor. Accordingly, there is shown a possibility that Syk synergistically acts in combination with a tyrosine kinase such as Lck, ZAP-70, or the like to take part in the T cell activation signal (Couture, C. et al., Proc. Natl. Acad. Sci. USA, 91: 5301-5305 (1994) and Couture, C. et al., Mol. Cell. Biol., 14: 5249-5258 (1994)).

Moreover, it has been reported that the tyrosine phosphorylation of intracellular protein and the phagocytosis induced by stimulation of immunoglobulin G (IgG) receptor (Fc γ R) are considerably inhibited in macrophages derived from Syk deficient mouse (Crowley, M. T. et al., J. Exp. Med., 186: 1027-1039 (1997)). Therefore, Syk plays an extremely important role in the Fc γ R-mediated phagocytosis of macrophage, and it is shown

that Syk is concerned in tissue damage induced by antibody-dependent cellular cytotoxicity (ADCC).

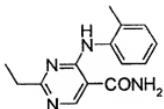
Furthermore, it has been reported that the release of arachidonic acid and serotonin and the aggregation of 5 platelets induced by collagen are markedly inhibited in platelets derived from Syk deficient mouse (Poole, A. et al., EMBO J., 16: 2333-2341 (1997)), so that participation in anticoagulation is also shown.

And, as compounds having a Syk inhibitory action, 10 there have been reported a 2-anilinopyrimidine derivative (WO98/18782) represented by the following formula:

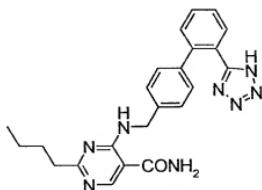


(wherein Ar represents an aromatic cyclic group which may 15 be substituted, and R² represents H, a halogen, or a group represented by -X¹-R^{2a}. Refer to the publication for other symbols), and a natural product derived from a plant, Piceatannol (Oliver, J. M. et al., J. Biol. Chem., 269: 29697-29703 (1994)).

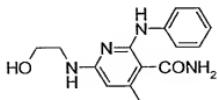
20 Moreover, as heterocyclecarboxamide derivatives having a substituted amino group, the following compound is disclosed in Indian J. Chem., Sect. B, 16B(10), 932-933 (1978),



the following compound in EP475206 and US5104877,



5 and the following compound in Japanese Patent Laid-Open No.
94677/1974,

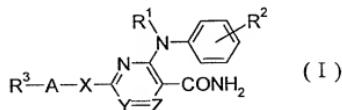


but the action on Syk of these compounds is neither
10 disclosed nor suggested.

Disclosure of the Invention

As a result of the extensive studies on the
compounds inhibiting Syk, the present inventors have found
15 that a heterocyclecarboxamide derivative has a satisfactory
Syk inhibitory activity and is useful as an agent for
preventing, treating, or diagnosing diseases in which Syk
takes part, and thereby have accomplished the invention.

5 Namely, the invention relates to a novel
heterocyclecarboxamide derivative represented by the
following general formula (I) or a pharmaceutically
acceptable salt thereof, and a medicament comprising the
same as the active ingredient.



(wherein the symbols in the formula have the following
meanings.

10 A: a lower alkylene which may have substituent(s), an
arylene which may have substituent(s), a heteroarylene
which may have substituent(s), a cycloalkylene which may
have substituent(s), or H;
X: NR⁴, CONR⁴, NR⁴CO, O, or S;
15 a dotted line between Y and Z: presence (Y=Z) or absence
(Y-Z) of a bond;
Y-Z: N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O);
Y=Z: N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷);
R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower
20 alkyl;
R²: H, a lower alkyl, a halogen, a lower alkyl substituted
by halogen(s), -O-lower alkyl, -S-lower alkyl, -O-aryl, -O-
lower alkylene-aryl, -S-lower alkylene-aryl, nitro, or
cyano group;

R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower alkylene-CO₂-lower alkyl, -CONHOH, -CONHO-lower alkyl, -lower alkylene-CONHOH, -lower alkylene-CONHO-lower alkyl, -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form);

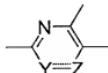
R⁵: H or a lower alkyl group;

R⁶: a lower alkyl, -OH, -O-lower alkyl, -O-aryl which may have substituent(s), -O-lower alkylene-aryl which may have substituent(s), -NR¹-aryl which may have substituent(s), -CO-lower alkyl, or -aryl group which may have substituent(s);

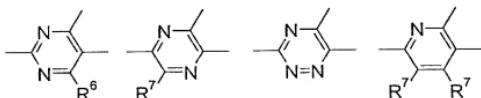
R⁷: the same or different, H or the same group as R⁶. The same shall apply to the following).

By the way, when Y=Z represents N=C(R⁶), C(R⁷)=N, N=N, or

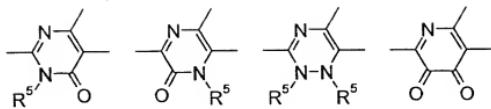
C(R⁷)=C(R⁷) in the formula, the central heterocycle part:



represents any of the following formulae:



and when Y-Z represents N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O) in the formula, the central heterocycle part represents any of the following formulae.



In the above formulae, there is a case that tautomers are present as the case of the compound wherein R⁶ of N=C(R⁶) is OH and the compound wherein R⁵ of C(R⁵)-C(O) is H or the case of the compound wherein R⁷ of C(R⁷)=N is OH and the compound wherein R⁵ of C(O)-N(R⁵) is H. The invention also includes these isomers.

According to the invention, also provided is a pharmaceutical composition, particularly a Syk tyrosine kinase inhibitor comprising the above heterocyclecacboxamide derivative or a salt thereof.

The following will explain the invention in detail.

In this specification, the term "lower" means a linear or branched hydrocarbon chain having from 1 to 6 carbon atoms. The "lower alkyl group" is preferably a lower alkyl group having from 1 to 4 carbon atoms, and more preferred is methyl, ethyl, or isopropyl group. The "lower alkylene" is preferably a lower alkylene having from 1 to 4 carbon atoms, and particularly preferred is methylene, ethylene, or butylene.

The "halogen" includes F, Cl, Br, and I. The "lower alkyl substituted by halogen(s)" is preferably fluoromethyl, trifluoromethyl, or trifluoroethyl group.

The "arylene", "heteroarylene", and "cycloalkylene" mean divalent groups formed by removing hydrogen atom at any position of "aryl group", "heteroaryl group", and "cycloalkyl group", respectively.

5 The "aryl group" is preferably a monocyclic to tricyclic aryl group having from 6 to 14 carbon atoms, more preferably, a phenyl group or a naphthyl group. Also, the phenyl group may be condensed with a five- to eight-membered cycloalkyl ring to form, for example, an indanyl 10 group or a 5,6,7,8-tetrahydronaphthyl group, which combines from the aromatic ring. The "arylene" is preferably 1,2-phenylene or 1,4-phenylene.

15 The "cycloalkyl group" is preferably a cycloalkyl group having from 3 to 8 carbon atoms. More preferred as the "cycloalkylene" is cyclohexane-1,1-diyl, 1,2-cyclopentylene, 1,2-cyclohexylene, or 1,4-cyclohexylene. Also, the cycloalkyl group may be condensed with a benzene ring to form, for example, 1- or 2-indanyl or a 1,2,3,4-tetrahydronaphthyl group.

20 The "heteroaryl group" is a five- to six-membered monocyclic heteroaryl group having from 1 to 4 hetero atoms selected from O, S and N, and is preferably pyridyl, pyrimidinyl, imidazolyl, thienyl, furyl, or thiazolyl group.

25 Substituents of the "lower alkylene which may have substituent(s)", "arylene which may have substituent(s)", "heteroarylene which may have substituent(s)",

"cycloalkylene which may have substituent(s)" and "aryl which may have substituent(s)" are not particularly limited so long as they can be used as substituents of these rings, but are preferably the substituents selected from the
5 following group. One to four of these substituents may be present.

-lower alkyl, -halogen, -lower alkyl substituted by halogen(s), -cycloalkyl, -heteroaryl, -nitrogen-containing saturated heterocycle, -vinyl, -(1-propenyl), -ethynyl, -OH, -O-lower alkyl, -O-lower alkylene-aryl, -O-aryl, -O-lower alkylene-aryl-O-lower alkyl, -S-lower alkylene-aryl, -S-lower alkylene-aryl-O-lower alkyl, -CONHOH, -CONH-lower alkyl, -CON(lower alkyl)₂, -NO₂, and -CN.

10 Moreover, the "-NH₂ in a prodrug form" means any of the groups well known by those skilled in the art, which forms -NH₂ under physiological conditions. For example, there are mentioned the groups described in Prog. Med., 5, 2157-2161 (1985) and "Iyakuhin no Kaihatsu (Pharmaceutical Research and Development)" (Hirokawa Publishing Co., 1990),
20 vol. 7, Bunshi Sekkei (Drug Design) 163-198. Preferred are (Z)-3-[2-(acetoxy)phenyl]-2-propenoylamino-, (acetoxy)methoxycarbonylamino-, 4-azidobenzyloxycarbonylamino-, (5-methyl-2-oxo-1,3-dioxol-
25 4-en-4-yl)methoxycarbonylamino- and [(2-hydroxyphenyl)(phenyl)methylidene]amino-, and other groups of this type known by those skilled in the art are also

included. In addition, prodrugs with regard to the groups such as OH and COOH are also included in the invention.

Among the compounds of the invention, A in the formula (I) is preferably a lower alkylene or 5 cycloalkylene, more preferably ethylene or cyclohexylene. R³ is preferably -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower alkylene-CO₂-lower alkyl, -NH₂, -(NH₂ in a 10 prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form), further preferably -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form), more preferably -NH₂ or -(NH₂ in a 15 prodrug form). X is preferably NR₄. Y-Z and Y=Z are preferably N(R⁵)-C(O), C(O)-N(R⁵), N=C(R⁶), C(R⁷)=N, or C(R⁷)=C(R⁷), further preferably N=C(R⁶), C(R⁷)=N, or C(R⁷)=C(R⁷).

Among the compounds of the present invention, the following compounds can be mentioned as most preferred compounds: 6-(2-aminoethylamino)-2-(3-ethylanilino)pyridine-3-carboxamide, 6-(2-aminoethylamino)-20 2-(3-trifluoromethylanilino)pyridine-3-carboxamide, 2-(2-aminoethylamino)-4-hydroxy-6-(3-methylanilino)pyrimidine-5-carboxamide, 6-(cis-2-aminocyclohexylamino)-2-(3-methylanilino)pyridine-3-carboxamide, 6-(cis-2-aminocyclohexylamino)-2-(3,5-dimethylanilino)pyridine-3-25 carboxamide, 5-(cis-2-aminocyclohexylamino)-3-(3-methylanilino)pyrazine-2-carboxamide, 5-(cis-2-aminocyclohexylamino)-3-(3-methoxyanilino)pyrazine-2-

carboxamide, 5-(*cis*-2-aminocyclohexylamino)-3-(3-phenoxyanilino)pyrazine-2-carboxamide, 5-(*cis*-2-aminocyclohexylamino)-3-(4-methylsulfanylanilino)pyrazine-2-carboxamide, 5-(*cis*-2-aminocyclohexylamino)-3-(3,5-dimethoxyanilino)pyrazine-2-carboxamide, 2-(*cis*-2-aminocyclohexylamino)-4-hydroxy-6-(3-methylanilino)pyrimidine-5-carboxamide, 2-(*cis*-2-aminocyclohexylamino)-4-(3-bromoanilino)-6-hydroxypyrimidine-5-carboxamide, 2-(*cis*-2-aminocyclohexylamino)-4-(2-chlorophenoxy)-6-(3-methylanilino)pyrimidine-5-carboxamide.

Depending on the kinds of substituents, the compound of the invention may exist in the form of geometrical isomers or tautomers, and isolated forms or mixtures of these isomers are included in the invention. Also, the compound of the present invention may contain an asymmetric carbon atom in some cases, so that isomers based on the asymmetric carbon atom may exist. Mixtures or isolated forms of these optical isomers are included in the present invention.

Also, the compound of the present invention sometimes forms an acid addition salt or, depending on the kinds of substituents, a salt with a base. Such salts are pharmaceutically acceptable salts, and illustrative examples thereof include acid addition salts with inorganic acids such as hydrochloric acid, hydrobromic acid, hydroiodic acid, sulfuric acid, nitric acid, phosphoric

acid and the like or with organic acids such as formic acid, acetic acid, propionic acid, oxalic acid, malonic acid, succinic acid, fumaric acid, maleic acid, lactic acid, malic acid, tartaric acid, citric acid,
5 methanesulfonic acid, ethanesulfonic acid, aspartic acid, glutamic acid and the like; salts with inorganic bases such as sodium, potassium, magnesium, calcium, aluminum and the like or with organic bases such as methylamine, ethylamine, ethanolamine, lysine, ornithine and the like; ammonium
10 salts, and the like. In addition, various types of hydrates and solvates and polymorphic substances of the compound (I) of the invention and salts thereof are also included in the invention.

(Production Methods)

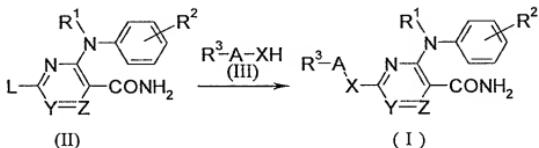
15 The compound of the present invention and pharmaceutically acceptable salt thereof can be produced by applying various known synthesis methods, making use of their characteristics based on the basic structures or kinds of substituents. At that time, depending on the
20 kinds of functional groups, it is sometimes effective, from the viewpoint of the production techniques, to replace said functional group by an appropriate protecting group, namely a group which can be easily converted into said functional group, at the step of the starting material or
25 intermediate. Thereafter, the desired compound can be obtained by removing the protecting group as occasion demands. Examples of such functional groups include amino

group, hydroxyl group, carboxyl group and the like.

Examples of their protecting groups include the protecting groups described in "Protective Groups in Organic Synthesis (2nd. Ed.)" edited by Greene and Wuts, and these groups are 5 optionally used depending on the reaction conditions.

The following describes typical production methods of the compounds of the invention.

First production method



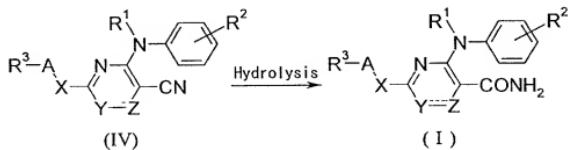
(wherein L represents a leaving group. Other symbols have the same meanings as described above)

This production method is a method in which the compound of the present invention represented by the 15 general formula (I) is obtained by reacting a compound (II) with a compound (III). In the method, examples of the leaving group L include halogen atoms and methylsulfonyl, 1H-benzotriazol-1-yloxy, methylsulfinyl, methanesulfonyl, methanesulfonyloxy, p-toluenesulfonyloxy, trifluoromethanesulfonyloxy, and the like.

The reaction can be carried out from under cooling to under heating to reflux using the compounds (II) and (III) in equimolar amounts or in an excess amount of one of them, without solvent or in a solvent inert to the reaction

such as aromatic hydrocarbons, e.g., benzene, toluene, xylene and the like; ethers, e.g., diethyl ether, tetrahydrofuran (THF), dioxane and the like; halogenated hydrocarbons, e.g., dichloromethane, 1,2-dichloroethane, 5 chloroform and the like; N,N-dimethylformamide (DMF); N,N-dimethylacetamide (DMA); N-methylpyrrolidone; ethyl acetate; acetonitrile; and the like. The reaction temperature can be optionally selected depending on the compounds. Depending on the compounds, it is advantageous 10 in some cases to carry out the reaction in the presence of an organic base (preferably diisopropylethylamine, N-methylmorpholine, pyridine, or 4-(N,N-dimethylamino)pyridine) or a metal salt base (preferably sodium hydride, potassium carbonate, sodium carbonate, 15 sodium hydrogen carbonate, sodium hydroxide, or potassium hydroxide).

Second production method



20 (wherein the symbols in the scheme are as defined in the above)

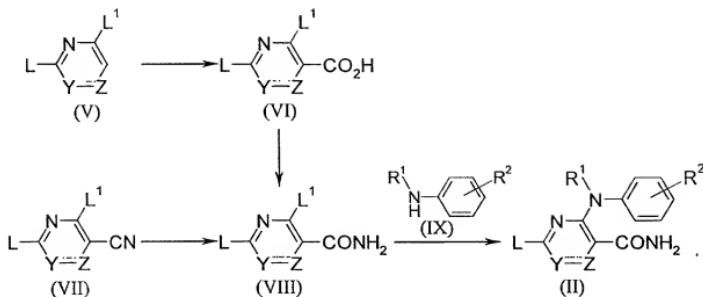
This production method is a method in which the compound (I) of the invention is obtained by converting the nitrile group of a nitrile compound (IV) into a carboxamido

group under various conditions. The reaction can be carried out from at room temperature to under heating to reflux without solvent or in a solvent inert to the reaction such as aromatic hydrocarbons; ethers; halogenated hydrocarbons; alcohols, e.g., methanol, ethanol and the like; DMF; pyridine; water; dimethyl sulfoxide (DMSO); and the like, in the presence of a mineral acid, e.g., sulfuric acid, hydrochloric acid, hydrobromic acid or the like; an organic acid, e.g., formic acid, acetic acid or the like; or a base, e.g., sodium hydroxide, potassium hydroxide, potassium carbonate, sodium carbonate, ammonia or the like. It is advantageous in some cases to carry out the reaction in the presence of hydrogen peroxide or the like, for the purpose of effecting smooth progress of the reaction. The reaction temperature can be selected optionally, depending on the compound.

Production Method of Starting Compounds

Starting compounds (II) and (IV) for the compound of the invention can be produced in the usual way, for example, by applying known reactions shown in the following scheme of synthetic pathway.

Production method 1



5 (wherein L¹ represents a leaving group similar to the above
I. Other symbols are as defined in the above)

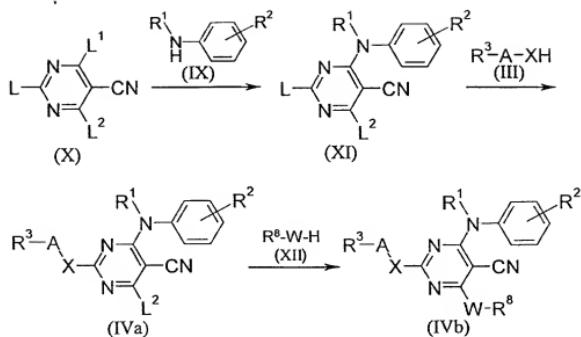
A starting compound (II) can be produced by
substitution reaction between a compound (VIII) and an
aniline derivative (IX). The reaction can be carried out
10 under conditions similar to the above first production
method.

The intermediate (VIII) can be produced by
treating a carboxylic acid compound (VI) with ammonia in
the presence of a condensing agent (e.g.,
15 dicyclohexylcarbodiimide (DCC), diisopropylcarbodiimide
(DIPC), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide
(WSC), 1,1'-carbonylbis-1H-imidazole (CDI), or the like)
and, in some cases, an additive (e.g., N-hydroxysuccinimide
(HONSu), 1-hydroxybenzotriazole (HOBT), or the like).
20 Examples of the solvent include aromatic hydrocarbons,
ethers, halogenated hydrocarbons, DMF, pyridine, and the

like. These solvents may be used solely or as a mixture of two or more of them.

The intermediate (VI) can be produced by introducing a carboxylic acid into a compound (V) under 5 various conditions. The reaction can be carried out from at -78°C to under ice cooling in a solvent inert to the reaction such as ethers or hexane by converting the compound into an anion under a basic condition (e.g., n-butyllithium, sec-butyllithium, tert-butyllithium, 2,2,6,6-10 tetramethylpiperidine lithium salt (LiTMP), diisopropylamine lithium salt (LDA), or the like, or N,N,N',N'-tetramethylethylenediamine, hexamethylphosphoramide (HMPA), DMA, or the like may be added thereto in order to assist the reaction), and then 15 adding dry ice or blowing carbon dioxide into the solution. The reaction temperature can be selected optionally, depending on the compound.

Moreover, the intermediate (VIII) can be also produced by hydrolyzing a nitrile compound (VII). The 20 conditions similar to those in the above second production method can be adopted as the reaction conditions.



(wherein L^2 represents a leaving group similar to the above
 L or R^6 or R^7 , R^8 represents -aryl which may have
 substituent(s), -lower alkylene-aryl which may have

5 substituent(s), or -aryl group which may have
 substituent(s), and W represents O or NR^1 . Other symbols
 are defined as in the above)

The starting compound (IVb) can be produced by
 reacting a compound (IVa) with a compound (XII). The
 10 reaction can be carried out from under cooling to under
 heating in a solvent inert to the reaction such as aromatic
 hydrocarbons, ethers, halogenated hydrocarbons, DMF, DMSO,
 pyridine, or the like. It is advantageous in some cases to
 carry out the reaction in the presence of a metal salt
 15 base, for the purpose of effecting smooth progress of the
 reaction.

The starting compound (IVa) can be produced by
 reacting a compound (XI) with the compound (III). The
 conditions similar to those in the above first production
 20 method can be adopted.

The intermediate (XI) can be produced by the substitution reaction between a nitrile compound (X) and an aniline compound (IX). The conditions similar to those in the above first production method can be adopted.

5 Furthermore, the compound wherein the substituent R¹ is an alkyl, -CO-lower alkyl, or -SO₂-lower alkyl can be produced in the usual way using the compound wherein R¹ is H. The introduction of an alkyl group can be carried out using an alkyl halide or an alkyl ester in a similar manner 10 to the above first production method. The introduction of the -CO-lower alkyl or -SO₂-lower alkyl group can be carried out from under cooling to under heating in a solvent inert to the reaction such as halogenated hydrocarbons, ethers, DMF, or the like by an acid halide 15 method, a mixed or symmetric acid anhydride method, an active ester method, a condensing agent (DCC, WSC, CDI, etc.) method, or the like. It is advantageous in some cases to carry out the reaction in the presence of a base, for the purpose of effecting smooth progress of the 20 reaction.

The reaction product obtained by each of the aforementioned production methods is isolated and purified as a free compound, a salt thereof or any of various types of solvate such as hydrate. Salts can be produced by the 25 usual salt-forming treatment.

The isolation and purification are carried out by employing usual chemical operations such as extraction,

concentration, evaporation, crystallization, filtration, recrystallization, various chromatographic techniques, and the like.

Various isomers can be isolated in the usual way
5 making use of a physicochemical difference among the isomers. For example, optical isomers can be separated by a general optical resolution method such as fractional crystallization or a chromatography. In addition, an optical isomer can also be produced from an appropriate
10 optically active starting compound.

Industrial Applicability

The compound of the invention is useful as an active ingredient for pharmaceutical preparations.

15 Particularly, since it has a Syk inhibitory activity, it is useful as an agent for preventing and treating the following diseases in which Syk takes part. The diseases in which an allergic or inflammatory reaction becomes the main cause (e.g., asthma, rhinitis, atopic dermatitis, contact dermatitis, nettle rash, food allergy, conjunctivitis, vernal conjunctivitis and the like); autoimmune diseases (e.g., rheumatoid arthritis, systemic lupus erythematosus, psoriasis and the like); cancers and the like; diseases in which immune reaction takes part
20 (e.g., rejection at the time of organ transplantation, graft versus host disease and the like); diseases in which ADCC takes part (e.g., autoimmune hemolytic anemia,

myasthenia gravis and the like); and diseases in which platelet agglutination takes part.

Actions of the compound of the invention have been confirmed by the following pharmacological tests.

5 1. Syk tyrosine kinase inhibition test

1) Preparation of Syk protein:

Human Syk gene, in the form where a gene of FLAG tag consisting of 8 amino acid residues was linked to the 3'-end, was cloned using RT-PCR method from total RNA 10 prepared from Jurkat cells. The amplified cDNA was incorporated into a vector, pFASTBAC HT, contained in Baculovirus Expression System (GIBCO BRL Inc.). The pFASTBAC HT is designed in such a manner that a His tag consisting of 6 histidine residues can be fused to the 5'- 15 end of Syk. This plasmid DNA was introduced into competent cells, DH10BAC, contained in the Baculovirus Expression System to prepare DNA of recombinant virus. Thereafter, the recombinant virus (culture supernatant) was obtained by transfection of the DNA of recombinant virus into Sf-9 20 cells (ATCC).

The Sf-9 cells infected with this recombinant virus were recovered and lysed using a lysis buffer containing 1% Triton X-100. After centrifugation of the soluble fraction, the supernatant was mixed with TALON 25 resin (CLONTECH) to allow the His-tag fused protein of Syk to be adsorbed by the resin. After several times of

washing of the resin, the His-tag fused protein of Syk was eluted with a buffer containing imidazole.

2) Preparation of Band 3 peptide:

A peptide of 18 amino acid residues

5 (MEELQDDYEDMMEENLEQ) (Sequence No.: 1) containing Tyr-8 of human erythrocyte Band 3 (Harrison, M. L. et al., J. Biol. Chem., 269: 955-959 (1994)) was synthesized using a peptide synthesizer. Using a biotinylation kit manufactured by Pierce, the N-terminal of the peptide in a resin-linked 10 state was biotinylated, and purification was carried out using an HPLC.

3) Measurement of Syk tyrosine kinase activity using an SPA system:

15 SPA (Scintillation Proximity Assay) is a system developed by Amersham making use of a phenomenon in which scintillation occurs when a molecule having a radioactivity is in the proximity of (linked to) the surface of plastic beads containing a scintillant included therein. These beads are coated in advance with streptoavidin to which the 20 biotin moiety of substrate peptide is bound.

A 2 μ l portion of a DMSO solution of a compound to be tested (final DMSO concentration, 4%) per well was added to 50 μ l of a reaction solution (composition: 0.2 μ g Syk, 50 mM Tris-HCl (pH 8), 10 mM MgCl₂, 50 mM NaCl, 1 mM DTT, 25 0.4 μ M Band 3 peptide and 0.1 μ Ci [γ -³³P]ATP (10 mCi/ml, Amersham)). This was prepared in OptiPlateTM (PACKARD) and

allowed to stand at room temperature (20 to 25°C) for 1 hour to effect tyrosine phosphorylation.

The reaction was terminated by adding PBS containing 0.25 mg SPA beads, 50 μ M ATP, 5 mM EDTA and 1% 5 Triton X-100 (reaction-terminating solution) in an amount of 150 μ l per well.

The plate was sealed, stirred, allowed to stand at room temperature for 15 minutes and then centrifuged at 1,500 rpm for 3 minutes to precipitate the SPA beads.

10 Radioactivity of each well was measured using TOP COUNT (PACKARD), and the tyrosine phosphorylation activity by Syk was calculated.

4) Results:

The compounds of Examples of the invention 15 exhibited an inhibitory activity of 0.05 μ M or less as IC₅₀ value against Syk. However, comparative compounds having a substituent in the carboxamido group, 2-(2-aminoethylamino)-N-methyl-4-(3-trifluoromethylanilino)pyrimidine-5-carboxamide and 2-(2-aminoethylamino)-N,N-dimethyl-4-(3-trifluoromethylanilino)pyrimidine-5-carboxamide did not 20 exhibit any inhibitory activity at 1 μ M.

2. Serotonin Release test

This was carried out in accordance with the method 25 reported by Collado-Escobar et al. (Collado-Escobar, D et al. J. Immunol., 144: 3449-3457 (1990)).

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The compound of Examples 1, 2, 8, 10, and 11 exhibited an inhibitory activity of 0.1 μ M or less as IC_{50} value against the release of serotonin.

3. Mouse passive cutaneous anaphylaxis (PCA) test

5 Male ICR (CD-1) mice of 5 weeks age were sensitized by subcutaneously injecting 10 μ l of anti-dinitrophenyl-IgE (DNP-IgE) (1,000 times dilution of a roughly purified product of ascites of Balb/c mouse to which a DNP-IgE producing hybridoma had been administered

10 by intraperitoneal injection) into the right ear pinna while lightly anesthetizing with ether. After 24 hours of the sensitization, 200 μ l of 0.5% Evans blue solution containing 50 μ g of DNP-conjugated bovine serum albumin was intravenously administered, and, after 30 minutes, each

15 mouse was sacrificed through exsanguination to isolate both ears. Each test compound or the vehicle alone as a control was administered subcutaneously 30 minutes before the antigen challenge or orally 2 hours before the challenge. The dye in the tissues was extracted with formamide and

20 colorimetrically determined at 620 nm. A value obtained by subtracting the dye content of the left ear from the dye content of the right ear was used as the amount of dye leaked into the tissues by the PCA reaction.

25 The PCA inhibition ratio by the test compound was calculated based on the following equation. In the formula, C: amount of the dye leaked into the tissue at the time of the administration of the vehicle alone, and X:

amount of the dye leaked into the tissue at the time of the administration of the test compound.

$$\text{Inhibition ratio (\%)} = \{C - X\} \times 100/C$$

The compounds of Examples 1, 2, 8, 10 and 11

5 excellently suppressed PCA reaction.

From the results of the above experiments 1 to 3, it is confirmed that the compound of the invention inhibits the release of inflammatory mediator and suppresses the anaphylaxis reaction, and especially has a Syk inhibitory 10 activity. Thus, it is obvious that the compound is useful as an agent for preventing and treating the diseases in which Syk takes part.

The pharmaceutical composition comprising one or two or more of the compounds represented by the general 15 formula (I) or salts thereof as the active ingredient can be prepared by generally used methods using pharmaceutical carriers, fillers and the like which are generally used in this field. Its administration form may be either oral administration by tablets, pills, capsules, granules, 20 powders, liquids and the like, or parenteral administration by intravenous, intramuscular and the like injections, suppositories, eye drops, eye ointments, percutaneous liquids, ointments, percutaneous adhesive preparations, transmucosal liquids, transmucosal adhesive preparations, 25 inhalants and the like.

The solid composition for use in the oral administration according to the invention is used in the

form of tablets, powders, granules and the like. In such a solid composition, one or more active substances are mixed with at least one inert diluent such as lactose, mannitol, glucose, hydroxypropylcellulose, microcrystalline

5 cellulose, starch, polyvinyl pyrrolidone, magnesium
aluminate metasilicate. In accordance with a conventional
method, the composition may contain other additives than
the inert diluent, such as a lubricant, e.g., magnesium
stearate or the like, a disintegrating agent, e.g., calcium
10 cellulose glycolate or the like, a stabilizing agent, e.g.,
lactose or the like, and a solubilization-assisting agent,
e.g., glutamic acid, aspartic acid or the like. If
necessary, tablets or pills may be coated with a sugar or a
film of gastric or enteric substance such as sucrose,
15 gelatin, hydroxypropylcellulose,
hydroxypropylmethylcellulose phthalate or the like.

The liquid composition for oral administration includes pharmaceutically acceptable emulsions, solutions, suspensions, syrups, elixirs and the like and contains a generally used inert diluent such as purified water or ethanol. In addition to the inert diluent, this composition may also contain auxiliary agents such as a solubilizing agent, a moistening agent, a suspending agent and the like, as well as sweeteners, flavors, aromatics and antiseptics.

The injections for parenteral administration include aseptic aqueous or non-aqueous solutions.

suspensions and emulsions. The aqueous solutions and suspensions include distilled water for injection or physiological saline. For the non-aqueous solutions and suspensions, propylene glycol, polyethylene glycol, vegetable oil such as olive oil, alcohols such as ethanol, polysorbate 80 (trade name) and the like may be used. Such a composition may further contain auxiliary agents such as a tonicity, an antiseptic, a moisturizing agent, an emulsifying agent, a dispersing agent, a stabilizing agent (e.g., lactose) and a solubilization-assisting agent (e.g., glutamic acid or aspartic acid). These compositions are sterilized by filtration through a bacteria-retaining filter, blending of a germicide, or irradiation.

Alternatively, they may be used by firstly making into sterile solid compositions and dissolving them in sterile water or a sterile solvent for injection prior to their use.

The transmucosal preparations such as transnasal preparations are in the solid, liquid or semisolid form and can be produced by methods known per se. For example, they are formed into a solid, liquid or semisolid state by optionally adding known pH adjusting agents, antiseptics, thickeners, excipients and the like. The transnasal preparations are administered using generally used sprayers, nasal drops containers, tubes, nasal cavity-inserting tools and the like.

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In the case of oral administration, the suitable daily dose is generally from about 0.001 to 100 mg/kg body weight, preferably from 0.1 to 10 mg/kg, which is administered in one portion or by dividing into two to four doses. In the case of intravenous injection, the suitable daily dose is from about 0.0001 to 10 mg/kg body weight, which is administered in one portion or by dividing into several doses. In the case of transmucosal preparations, a dose of from about 0.001 to 10 mg/kg body weight is administered once a day or by dividing into several doses. The dose is optionally determined in consideration of symptoms, age, sex and the like at individual case.

Best Mode for Carrying Out the Invention

The following describes the invention further in detail based on Examples. Compounds of the invention are not limited to the compounds described in the following Examples. In addition, methods for producing starting compounds are shown as Reference Examples.

20 Reference Example 1

To a THF solution of 2,2,6,6-tetramethylpiperidine was added n-butyllithium under ice cooling and was further added a THF solution of 2,6-dichloropyrazine at -78°C. After 30 minutes of stirring, dry ice was added to the reaction mixture and, after 30 minutes of stirring, 1 M hydrochloric acid was added thereto. Thereafter, purification in the usual way afforded 3,5-

dichloropyrazine-2-carboxylic acid (pale yellow solid).

FAB-MS: 191 (M-H)⁻.

Reference Example 2

Thionyl chloride was added to 3,5-

5 dichloropyrazine-2-carboxylic acid, followed by heating to reflux for 30 minutes. Then, solvent was removed by evaporation under reduced pressure. Dichloromethane was added to the residue and aqueous ammonia was added thereto under ice cooling. After 1 hour of stirring, purification 10 in the usual way afforded 3,5-dichloropyrazine-2-carboxamide (pale yellow solid). FAB-MS: 192 (M+H)⁺.

Reference Example 3

Conc. hydrochloric acid was added to (1'S,1R,2S)-

N-[2-(1'-phenylethylamino)cyclohexylamino]benzamide

15 monohydrochloride synthesized according to the method described in a literature (W. H. Schlichter and A. W. Frahm, Arch. Pharm., 326, 429-436 (1993)), followed by heating to reflux for 3 days. Thereafter, purification was carried out in the usual way and then formation of a salt 20 was carried out to obtain (1'S,1R,2S)-2-(1'-phenylethylamino)cyclohexylamine dihydrochloride (colorless solid). FAB-MS: 219 (M+H)⁺.

Reference Example 4

To an acetonitrile solution of 3,5-

25 dichloropyrazine-2-carboxamide were added 3-methylaniline and N,N-diisopropylethylamine, followed by heating to reflux for 17 hours. Thereafter, purification in the usual

way afforded 5-chloro-3-(3-methylanilino)pyrazine-2-carboxamide (yellow solid).

Reference Example 5

Potassium carbonate and 31% aqueous hydrogen

5 peroxide solution were added to a DMSO solution of 6-(3-bromoanilino)-2-[cis-2-(tert-butoxycarbonylamino)cyclohexylamino]-4-chloropyrimidine-5-carbonitrile, followed by stirring at room temperature for 13 hours. Thereafter, purification in the usual way
10 afforded 6-(3-bromoanilino)-2-[cis-2-(tert-butoxycarbonylamino)cyclohexylamino]-4-hydroxypyrimidine-5-carboxamide (yellow solid).

Reference Example 6

o-Chlorophenol and 60% sodium hydride were added

15 to a mixture of 2-[cis-2-(tert-butoxycarbonylamino)cyclohexylamino]-4-chloro-6-(3-methylanilino)pyrimidine-5-carbonitrile and DMF, followed by stirring at room temperature for 30 minutes and at 70°C for 5 hours. Thereafter, purification in the usual way
20 afforded 2-[cis-2-(tert-butoxycarbonylamino)cyclohexylamino]-4-(2-chlorophenoxy)-6-(3-methylanilino)pyrimidine-5-carbonitrile (colorless solid).

Reference Example 7

25 To a mixture of benzyl alcohol and DMF was added 60% sodium hydride under ice cooling and then 2-[cis-2-(tert-butoxycarbonylamino)cyclohexylamino]-6-chloro-4-(3-

methylanilino)pyrimidine-5-carbonitrile was added thereto, followed by stirring at 60°C for 40 minutes. Then, distilled water was added to the reaction liquid and the resulting precipitate was collected by filtration. The 5 filtration product was treated in a similar manner to Reference Example 4 to obtain 2-(*cis*-2-aminocyclohexylamino)-4-benzyloxy-6-(3-methylanilino)pyrimidine-5-carboxyamide (colorless solid).

In the following, using commercially available 10 compounds or compounds known in literatures and the like, the compounds of Reference Examples 8 to 23 shown in Table 1 were produced in a similar manner to above Reference Example 4, and the compounds of Reference Examples 24 and 25 shown in Table 1 were produced in a similar manner to 15 Reference Example 5 using corresponding starting materials. Structures and physicochemical data of the compounds of Reference Examples 4 to 25 are shown in Table 1.

Example 1

To a mixture of 233 mg of 6-chloro-2-(3-methylanilino)pyridine-3-carboxamide and toluene was added 20 486 mg of *cis*-1,2-cyclohexanediamine, followed by heating to reflux for 5 days. The reaction mixture was cooled to room temperature and the resulting precipitate was 25 collected by filtration to obtain 172 mg of 6-(*cis*-2-aminohexylamino)-2-(3-methylanilino)pyridine-3-carboxamide monohydrochloride as brown solid.

Example 2

To a mixture of 605 mg of 5-chloro-3-(3-methylanilino)pyrazine-2-carboxamide and 10 ml of acetonitrile was added 2.76 ml of cis-1,2-cyclohexanediamine, followed by heating to reflux for 4 hours. The reaction mixture was cooled to room temperature and the resulting precipitate was collected by filtration. The resulting solid was dissolved in a mixed solvent of chloroform and 2-propanol. The solution was washed with 1 M aqueous sodium hydroxide solution and saturated saline, successively, and dried over sodium sulfate. Then, the solution was concentrated under reduced pressure and the residue was recrystallized from a mixed solvent of DMF-ethyl acetate to obtain 230 mg of 5-(cis-2-aminoethylamino)-3-(3-methylanilino)pyrazine-2-carboxamide as yellow crystals.

Example 3

To a mixture of 558 mg of 2-(cis-2-aminoethylamino)-4-benzyloxy-6-(3-methylanilino)pyrimidine-5-carboxamide, 10 ml of ethanol, and 20 ml of THF was added 200 mg of 10% palladium-carbon powder, followed by stirring at room temperature for 1 hour under hydrogen atmosphere of normal pressure. Distilled water was added to the reaction mixture, the resulting mixture was filtrated, and the filtrate was concentrated under reduced pressure. The residue was recrystallized from a mixed solvent of ethanol-water to obtain 267 mg of 2-(cis-2-

aminohexylamino)-4-hydroxy-6-(3-methylanilino)pyrimidine-5-carboxamide as colorless solid.

Example 4

To a mixture of 326 mg of 6-(3-bromoanilino)-2-

5 [cis-2-(tert-butoxycarbonylamino)hexylamino]-4-hydroxypyrimidine-5-carboxamide and 10 ml of methanol was added 5 ml of a solution of 4 M hydrochloric acid-ethyl acetate, followed by stirring at room temperature for 12 hours. After the reaction, the resulting precipitate was 10 collected by filtration to obtain 110 mg of 6-(3-bromoanilino)-2-(cis-2-aminocyclohexylamino)-4-hydroxypyrimidine-5-carboxamide (colorless solid).

The compounds of Examples 5 to 7 shown in Table 2 were produced in a similar manner to Example 1, the 15 compounds of Examples 8 to 11 shown in Table 2 were produced in a similar manner to Example 2, the compounds of Examples 12 to 14 shown in Table 2 were produced in a similar manner to Example 3, and the compounds of Examples 15 and 16 were produced in a similar manner to Example 4, 20 using corresponding raw materials. Structures and physicochemical data of the compounds of Examples 1 to 16 are shown in Table 2.

Also, structures of other compounds of the invention are shown in Tables 3 to 11. These compounds can 25 be easily synthesized according to the aforementioned production methods and the methods described in the

Examples, as well as the methods which are obvious to those skilled in the art or modified methods thereof.

The following abbreviations are used in the tables. Also, the number before each substituent group indicates the substitution position, and plural numbers indicates plural substitutions. For example, 3,5-Me indicates 3,5-dimethyl.

Rex: Reference Example number, Ex: Example number,

Cmpd: compound number, Ph: phenyl, Me: methyl, Et: ethyl,

10 tBu: tert-butyl, Boc: tBuO-CO-, Bn: benzyl, Ac: acetyl,

BCA: cis-2-(tert-butoxycarbonylamino)cyclohexylamino, PEA:

(1'S,1R,2S)-2-(1'-phenylethylamino)cyclohexylamino, CCA:

cis-2-aminocyclohexylamino, ACA: (1R,2S)-2-

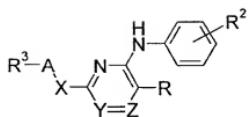
aminocyclohexylamino. Sal: salt (blank space: free form;

15 HCl: hydrochloride), Dat: physicochemical data (F: FAB-MS (M+H)⁺; FN: FAB-MS (M-H)⁻; M: melting point (°C); A:

specific rotation $[\alpha]_D$ (MeOH)). Also, a compound in which R² is 3,4-(CH)₄ represents a 2-naphthyl group together with the adjacent benzene ring, and OCH₂O represents

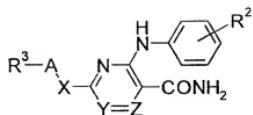
20 methylenedioxy group.

Table 1

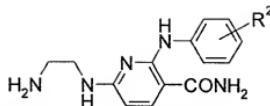


| Rex | R ³ -A-X- | R ² | Y | Z | R | Dat |
|-----|---|-------------------|----|--------------|-------------------|---------|
| 4 | Cl | 3-Me | CH | N | CONH ₂ | F: 263 |
| 5 | BCA | 3-Br | N | C-OH | CONH ₂ | F: 522 |
| 6 | BCA | 3-Me | N | C-O(2-Cl-Ph) | CN | F: 549 |
| 7 | CCA | 3-Me | N | C-OBn | CONH ₂ | F: 447 |
| 8 | Cl | 3-MeO | CH | N | CONH ₂ | F: 279 |
| 9 | Cl | 3-PhO | CH | N | CONH ₂ | FN: 339 |
| 10 | Cl | 3,5-MeO | CH | N | CONH ₂ | F: 309 |
| 11 | Cl | 4-MeS | CH | N | CONH ₂ | F: 294 |
| 12 | Cl | 3-Me | CH | CH | CONH ₂ | F: 262 |
| 13 | Cl | 3-CF ₃ | CH | CH | CONH ₂ | F: 316 |
| 14 | Cl | 3-Et | CH | CH | CONH ₂ | F: 276 |
| 15 | Cl | 3,5-Me | CH | CH | CONH ₂ | F: 276 |
| 16 | Cl | 3-Me | N | C-Cl | CN | F: 279 |
| 17 | Cl | 3-Br | N | C-Cl | CN | F: 344 |
| 18 | BocHN<chem>\backslash</chem>N<chem>H</chem> | 3-Me | N | C-Cl | CN | FN: 401 |
| 19 | BCA | 3-Me | N | C-Cl | CN | F: 457 |
| 20 | BCA | 3-Br | N | C-Cl | CN | F: 522 |
| 21 | PEA | 3-Me | CH | N | CONH ₂ | F: 445 |
| 22 | PEA | 3-MeO | CH | N | CONH ₂ | F: 461 |
| 23 | PEA | 3,5-MeO | CH | N | CONH ₂ | F: 491 |
| 24 | BocHN<chem>\backslash</chem>N<chem>H</chem> | 3-Me | N | C-OH | CONH ₂ | F: 403 |
| 25 | BCA | 3-Me | N | C-O(2-Cl-Ph) | CONH ₂ | F: 567 |

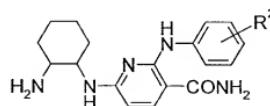
Table 2



| Ex | R ³ -A-X- | R ² | Y | Z | Sal | Dat |
|----|----------------------|-------------------|----|--------------|-----|-----------------------|
| 1 | CCA | 3-Me | CH | CH | HCl | F:340 |
| 2 | CCA | 3-Me | CH | N | | F:341; M:221-224 |
| 3 | CCA | 3-Me | N | C-OH | | F:357; M:280-285 |
| 4 | CCA | 3-Br | N | C-OH | HCl | F:421, 423 |
| 5 | | 3-CF ₃ | CH | CH | | F:340; M:172-176 |
| 6 | | 3-Et | CH | CH | | F: 300; M:134-136 |
| 7 | CCA | 3,5-Me | CH | CH | HCl | F:354 |
| 8 | CCA | 3-MeO | CH | N | | F:357; M:194-197 |
| 9 | CCA | 3-PhO | CH | N | | F:419 |
| 10 | CCA | 3,5-MeO | CH | N | | F:387; M:210-212 |
| 11 | CCA | 4-MeS | CH | N | | F:373 |
| 12 | ACA | 3-Me | CH | N | | F:341; A:+78° (C=0.1) |
| 13 | ACA | 3-MeO | CH | N | | F:357; A:+89° (C=0.2) |
| 14 | ACA | 3,5-MeO | CH | N | | F:387; A:+82° (C=0.2) |
| 15 | CCA | 3-Me | N | C-O(2-Cl-Ph) | | F:467 |
| 16 | | 3-Me | N | C-OH | | F:303 |

Table 3

| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 1 | 2-Br | 10 | 2-H ₂ N | 19 | 2-PhO | 28 | 2-Bu |
| 2 | 3-Br | 11 | 3-H ₂ N | 20 | 3-PhO | 29 | 3-Bu |
| 3 | 4-Br | 12 | 4-H ₂ N | 21 | 4-PhO | 30 | 4-Bu |
| 4 | 2-Cl | 13 | 2-Ac | 22 | 2-MeO | 31 | 3,5-Cl |
| 5 | 3-Cl | 14 | 3-Ac | 23 | 3-MeO | 32 | 3,5-MeO |
| 6 | 4-Cl | 15 | 4-Ac | 24 | 4-MeO | 33 | 3,5-Me |
| 7 | 2-HOCH ₂ | 16 | 2-MeS | 25 | 2-Me | 34 | 2,3-OCH ₂ O |
| 8 | 3-HOCH ₂ | 17 | 3-MeS | 26 | 3-Me | 35 | 3,4-OCH ₂ O |
| 9 | 4-HOCH ₂ | 18 | 4-MeS | 27 | 4-Me | 36 | 3,4-(CH) ₄ |

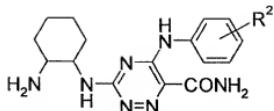
Table 4

| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 37 | 2-Br | 46 | 2-H ₂ N | 55 | 2-PhO | 64 | 3-Et |
| 38 | 3-Br | 47 | 3-H ₂ N | 56 | 3-PhO | 65 | 4-Et |
| 39 | 4-Br | 48 | 4-H ₂ N | 57 | 4-PhO | 66 | 3-Pr |
| 40 | 2-Cl | 49 | 2-Ac | 58 | 2-MeO | 67 | 3-Bu |
| 41 | 3-Cl | 50 | 3-Ac | 59 | 3-MeO | 68 | 3,5-Cl |
| 42 | 4-Cl | 51 | 4-Ac | 60 | 4-MeO | 69 | 3,5-MeO |
| 43 | 2-HOCH ₂ | 52 | 2-MeS | 61 | 2-Me | 70 | 2,3-OCH ₂ O |
| 44 | 3-HOCH ₂ | 53 | 3-MeS | 62 | 4-Me | 71 | 3,4-OCH ₂ O |
| 45 | 4-HOCH ₂ | 54 | 4-MeS | 63 | 2-Et | 72 | 3,4-(CH) ₄ |

Table 5

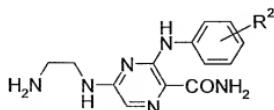
| Cmpd | R ³ -A-X- | R ² | Cmpd | R ³ -A-X- | R ² |
|------|----------------------|----------------|------|----------------------|----------------|
| 73 | | 3-Me | 97 | | 3-Me |
| 74 | | 3-Br | 98 | | 3-Br |
| 75 | | 3-MeO | 99 | | 3-MeO |
| 76 | | 3-Me | 100 | | 3-Me |
| 77 | | 3-Br | 101 | | 3-Br |
| 78 | | 3-MeO | 102 | | 3-MeO |
| 79 | | 3-Me | 103 | | 3-Me |
| 80 | | 3-Br | 104 | | 3-Br |
| 81 | | 3-MeO | 105 | | 3-MeO |
| 82 | | 3-Me | 106 | | 3-Me |
| 83 | | 3-Br | 107 | | 3-Br |
| 84 | | 3-MeO | 108 | | 3-MeO |
| 85 | | 3-Me | 109 | | 3-Me |
| 86 | | 3-Br | 110 | | 3-Br |
| 87 | | 3-MeO | 111 | | 3-MeO |
| 88 | | 3-Me | 112 | | 3-Me |
| 89 | | 3-Br | 113 | | 3-Br |
| 90 | | 3-MeO | 114 | | 3-MeO |
| 91 | | 3-Me | 115 | | 3-Me |
| 92 | | 3-Br | 116 | | 3-Br |
| 93 | | 3-MeO | 117 | | 3-MeO |
| 94 | | 3-Me | 118 | | 3-Me |
| 95 | | 3-Br | 119 | | 3-Br |
| 96 | | 3-MeO | 120 | | 3-MeO |

Table 6



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 121 | 2-Br | 130 | 2-H ₂ N | 139 | 2-PhO | 148 | 2-Et |
| 122 | 3-Br | 131 | 3-H ₂ N | 140 | 3-PhO | 149 | 3-Et |
| 123 | 4-Br | 132 | 4-H ₂ N | 141 | 4-PhO | 150 | 4-Et |
| 124 | 2-Cl | 133 | 2-Ac | 142 | 2-MeO | 151 | 3,5-Cl |
| 125 | 3-Cl | 134 | 3-Ac | 143 | 3-MeO | 152 | 3,5-MeO |
| 126 | 4-Cl | 135 | 4-Ac | 144 | 4-MeO | 153 | 3,5-Me |
| 127 | 2-HOCH ₂ | 136 | 2-MeS | 145 | 2-Me | 154 | 2,3-OCH ₂ O |
| 128 | 3-HOCH ₂ | 137 | 3-MeS | 146 | 3-Me | 155 | 3,4-OCH ₂ O |
| 129 | 4-HOCH ₂ | 138 | 4-MeS | 147 | 4-Me | 156 | 3,4-(CH) ₄ |

Table 7

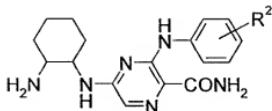


| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|----------------|------|---------------------|------|----------------|------|------------------------|
| 157 | 2-Br | 166 | 2-HOCH ₂ | 175 | 2-MeS | 184 | 4-Me |
| 158 | 3-Br | 167 | 3-HOCH ₂ | 176 | 3-MeS | 185 | 2-Et |
| 159 | 4-Br | 168 | 4-HOCH ₂ | 177 | 4-MeS | 186 | 3-Et |
| 160 | 2-Cl | 169 | 2-H ₂ N | 178 | 2-PhO | 187 | 4-Et |
| 161 | 3-Cl | 170 | 3-H ₂ N | 179 | 3-PhO | 188 | 3,5-MeO |
| 162 | 4-Cl | 171 | 4-H ₂ N | 180 | 4-PhO | 189 | 3,5-Me |
| 163 | 2-F | 172 | 2-Ac | 181 | 2-MeO | 190 | 2,3-OCH ₂ O |
| 164 | 3-F | 173 | 3-Ac | 182 | 4-MeO | 191 | 3,4-OCH ₂ O |
| 165 | 4-F | 174 | 4-Ac | 183 | 2-Me | 192 | 3,4-(CH) ₄ |

Table 8

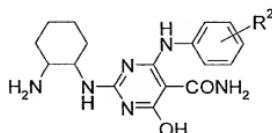
| Cmpd | R ³ -A-X- | R ² | Cmpd | R ³ -A-X- | R ² |
|------|----------------------|----------------|------|----------------------|----------------|
| 193 | | 3-Me | 217 | | 3-Me |
| 194 | | 3-Br | 218 | | 3-Br |
| 195 | | 3-MeO | 219 | | 3-MeO |
| 196 | | 3-Me | 220 | | 3-Me |
| 197 | | 3-Br | 221 | | 3-Br |
| 198 | | 3-MeO | 222 | | 3-MeO |
| 199 | | 3-Me | 223 | | 3-Me |
| 200 | | 3-Br | 224 | | 3-Br |
| 201 | | 3-MeO | 225 | | 3-MeO |
| 202 | | 3-Me | 226 | | 3-Me |
| 203 | | 3-Br | 227 | | 3-Br |
| 204 | | 3-MeO | 228 | | 3-MeO |
| 205 | | 3-Me | 229 | | 3-Me |
| 206 | | 3-Br | 230 | | 3-Br |
| 207 | | 3-MeO | 231 | | 3-MeO |
| 208 | | 3-Me | 232 | | 3-Me |
| 209 | | 3-Br | 233 | | 3-Br |
| 210 | | 3-MeO | 234 | | 3-MeO |
| 211 | | 3-Me | 235 | | 3-Me |
| 212 | | 3-Br | 236 | | 3-Br |
| 213 | | 3-MeO | 237 | | 3-MeO |
| 214 | | 3-Me | 238 | | 3-Me |
| 215 | | 3-Br | 239 | | 3-Br |
| 216 | | 3-MeO | 240 | | 3-MeO |

Table 9



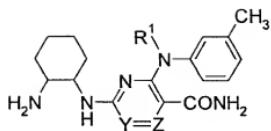
| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|-------------------|------|------------------------|
| 241 | 2-Br | 250 | 2-H ₂ N | 259 | 2-PhO | 268 | 2-CN |
| 242 | 4-Br | 251 | 3-H ₂ N | 260 | 4-PhO | 269 | 3-CN |
| 243 | 2-Cl | 252 | 4-H ₂ N | 261 | 2-MeO | 270 | 4-CN |
| 244 | 4-Cl | 253 | 2-Ac | 262 | 4-MeO | 271 | 3,5-Br |
| 245 | 2-F | 254 | 3-Ac | 263 | 2-Et | 272 | 3,5-Cl |
| 246 | 4-F | 255 | 4-Ac | 264 | 4-Et | 273 | 3,5-F |
| 247 | 2-HOCH ₂ | 256 | 2-MeS | 265 | 2-NO ₂ | 274 | 2,3-OCH ₂ O |
| 248 | 3-HOCH ₂ | 257 | 3-MeS | 266 | 3-NO ₂ | 275 | 3,4-OCH ₂ O |
| 249 | 4-HOCH ₂ | 258 | 4-MeS | 267 | 4-NO ₂ | 276 | 3,4-(CH) ₄ |

Table 10



| Cmpd | R ² | Cmpd | R ² | Cmpd | R ² | Cmpd | R ² |
|------|---------------------|------|--------------------|------|----------------|------|------------------------|
| 277 | 2-F | 286 | 2-H ₂ N | 295 | 2-PhO | 304 | 2-Bu |
| 278 | 3-F | 287 | 3-H ₂ N | 296 | 3-PhO | 305 | 3-Bu |
| 279 | 4-F | 288 | 4-H ₂ N | 297 | 4-PhO | 306 | 4-Bu |
| 280 | 2-Cl | 289 | 2-Ac | 298 | 2-MeO | 307 | 3,5-Cl |
| 281 | 3-Cl | 290 | 3-Ac | 299 | 3-MeO | 308 | 3,5-MeO |
| 282 | 4-Cl | 291 | 4-Ac | 300 | 4-MeO | 309 | 3,5-Me |
| 283 | 2-HOCH ₂ | 292 | 2-MeS | 301 | 2-Et | 310 | 2,3-OCH ₂ O |
| 284 | 3-HOCH ₂ | 293 | 3-MeS | 302 | 3-Et | 311 | 3,4-OCH ₂ O |
| 285 | 4-HOCH ₂ | 294 | 4-MeS | 303 | 4-Et | 312 | 3,4-(CH) ₄ |

Table 11

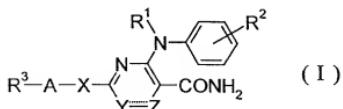


| Cmpd | R¹ | Y | Z | Cmpd | R¹ | Y | Z |
|------|-------|----|----|------|----|---|----------|
| 313 | Me | CH | CH | 319 | H | N | C(NHPh) |
| 314 | Ac | | | 320 | | | C(NMePh) |
| 315 | MeSO₂ | | | 321 | | | C-Me |
| 316 | Me | | | 322 | | | C-Ph |
| 317 | Ac | | | 323 | | | C-OMe |
| 318 | MeSO₂ | | | | | | |

Claims

1. A heterocyclecarboxamide derivative represented by the general formula (I) or a salt thereof.

5



[wherein the symbols in the formula have the following meanings.

A: a lower alkylene which may have substituent(s), an arylene which may have substituent(s), a heteroarylene which may have substituent(s), or a cycloalkylene which may have substituent(s);

10 X: NR⁴, CONR⁴, NR⁴CO, O, or S;

a dotted line between Y and Z: presence (Y=Z) or absence 15 (Y-Z) of a bond;

Y-Z: N(R⁵)-C(O), C(O)-N(R⁵), N(R⁵)-N(R⁵), or C(O)-C(O);

Y=Z: N=C(R⁶), C(R⁷)=N, N=N, or C(R⁷)=C(R⁷);

R¹, R⁴: H, a lower alkyl, -CO-lower alkyl, or -SO₂-lower alkyl;

20 R²: H, a lower alkyl, a halogen, a lower alkyl substituted by halogen(s), -O-lower alkyl, -S-lower alkyl, -O-aryl, -O-lower alkylene-aryl, -S-lower alkylene-aryl, nitro, or cyano group;

R³: -CO₂H, -CO₂-lower alkyl, -lower alkylene-CO₂H, -lower 25 alkylene-CO₂-lower alkyl, -CONHOH, -CONHO-lower

alkyl, -lower alkylene-CONHOH, -lower alkylene-CONHO-lower alkyl, -NH₂, -(NH₂ in a prodrug form), -lower alkylene-NH₂, or -lower alkylene-(NH₂ in a prodrug form);

R⁵: the same or different, H or a lower alkyl group;

5 R⁶: a lower alkyl, -OH, -O-lower alkyl, -O-aryl which may have substituent(s), -O-lower alkylene-aryl which may have substituent(s), -NR¹-aryl which may have substituent(s), -CO-lower alkyl, or -aryl group which may have substituent(s);

10 R⁷: the same or different, H or the same group as R⁶]

2. The compound or a salt thereof according to claim 1, wherein X is NR⁴ and A is a lower alkylene or cycloalkylene.

15 3. The compound or a salt thereof according to claim 2, wherein Y=Z is N=C(R⁶), C(R⁷)=N, or C(R⁷)=C(R⁷).

4. The compound or a salt thereof according to claim 1, wherein the compound is selected from 6-(2-aminoethylamino)-2-(3-ethylanilino)pyridine-3-carboxamide, 6-(2-aminoethylamino)-2-(3-trifluoromethylanilino)pyridine-3-carboxamide, 2-(2-aminoethylamino)-4-hydroxy-6-(3-methylanilino)pyrimidine-5-carboxamide, 6-(cis-2-aminocyclohexylamino)-2-(3-methylanilino)pyridine-3-carboxamide, 6-(cis-2-aminocyclohexylamino)-2-(3,5-dimethylanilino)pyridine-3-carboxamide, 5-(cis-2-aminocyclohexylamino)-3-(3-methylanilino)pyrazine-2-carboxamide, 5-(cis-2-aminocyclohexylamino)-3-(3-methoxyanilino)pyrazine-2-carboxamide, 5-(cis-2-

aminocyclohexylamino)-3-(3-phenoxyanilino)pyrazine-2-carboxamide, 5-(cis-2-aminocyclohexylamino)-3-(4-methylsulfanylanilino)pyrazine-2-carboxamide, 5-(cis-2-aminocyclohexylamino)-3-(3,5-dimethoxyanilino)pyrazine-2-carboxamide, 2-(cis-2-aminocyclohexylamino)-4-hydroxy-6-(3-methylanilino)pyrimidine-5-carboxamide, 2-(cis-2-aminocyclohexylamino)-4-(3-bromoanilino)-6-hydroxypyrimidine-5-carboxamide, and 2-(cis-2-aminocyclohexylamino)-4-(2-chlorophenoxy)-6-(3-methylanilino)pyrimidine-5-carboxamide.

5. A pharmaceutical composition which comprises the compound according to claim 1 or a salt thereof and a pharmaceutically acceptable carrier.

6. A pharmaceutical composition which comprises the compound according to claim 1 which is a Syk inhibitor or a salt thereof and a pharmaceutically acceptable carrier.

Abstract

A nitrogen-containing six-membered heterocyclic compound having substituents $-X-A-R^3$, $-N(R^1)-(Ph$ substituted by R^2), and $-CONH_2$, or a salt thereof.

5 (The symbols have the following meanings.

A: a lower alkylene which may have substituent(s), an arylene which may have substituent(s), a heteroarylene which may have substituent(s), or a cycloalkylene which may have substituent(s);

10 X: NR^4 , $CONR^4$, NR^4CO , O, or S;

R^1 , R^4 : H, a lower alkyl, $-CO$ -lower alkyl, or $-SO_2$ -lower alkyl;

R^2 : H, a lower alkyl, a halogen, a lower alkyl substituted by halogen(s), $-O$ -lower alkyl, $-S$ -lower alkyl, $-O$ -aryl, $-O$ -lower alkylene-aryl, $-S$ -lower alkylene-aryl, nitro, or cyano group;

R^3 : $-CO_2H$, $-CO_2$ -lower alkyl, $-lower$ alkylene- CO_2H , $-lower$ alkylene- CO_2 -lower alkyl, $-CONHOH$, $-CONHO$ -lower alkyl, $-lower$ alkylene- $CONHOH$, $-lower$ alkylene- $CONHO$ -lower alkyl, $-NH_2$, $-(NH_2$ in a prodrug form), $-lower$ alkylene- NH_2 , or $-lower$ alkylene- $(NH_2$ in a prodrug form)

SEQUENCE LISTING

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<130> Q67050

<150> JPA No. Hei 11-162692
<151> 1999-06-09

<150> PCT/JP00/03767
<151> 2000-06-09

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1 5 10 15

Glu Gln

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

NOVEL HETEROCYCLECARBOXAMIDE DERIVATIVE

The specification of which is attached hereto unless the following box is checked:

was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information of which is material to the patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

| | | | |
|-------------------------------|--------------------|---------------------------------------|--------------------------|
| P. Hei. 11-162692 (Number) | Japan (Country) | 9/June/1999 (Day/Month/Year Filed) | <input type="checkbox"/> |
| _____ (Number) | _____ (Country) | _____ (Day/Month/Year Filed) | <input type="checkbox"/> |
| _____ (Number) | _____ (Country) | _____ (Day/Month/Year Filed) | <input type="checkbox"/> |

I hereby claim the benefits under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

| | |
|-------------------------------|------------------------|
| _____ (Application Number) | _____ (Filing Date) |
|-------------------------------|------------------------|

I hereby claim the benefits under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

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| _____ (Application Number) | _____ (Filing Date) | _____ (Status - patented, pending, abandoned) |
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| _____ (Application Number) | _____ (Filing Date) | _____ (Status - patented, pending, abandoned) |
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I hereby appoint John H. Mion, Reg. No. 18,879; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; Louis Gubinsky, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Alan J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,685; Alan J. Kasper, Reg. No. 25,426; Kenneth J. Burchfield, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannan, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,726; Paul F. Neils, Reg. No. 33,102; Brett S. Sylvester, Reg. No. 32,765 and Robert M. Masters, Reg. No. 35,603; my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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